

## Whole Earth Spectra with the Atmospheric Infrared Sounder

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Our investigation is underway of mid-IR spectra of Earth obtained by the Atmospheric Infrared Sounder (AIRS) instrument on-board the AQUA spacecraft to explore the characteristics that may someday be observed in other planets with the Terrestrial Planet Finder (TPF). We are using the spectra to construct directly observed high resolution spectra of the only known life bearing planet, Earth. Previously, whole Earth spectra have been obtained indirectly by looking at reflected light (“Earthshine”) from the dark side of the Moon. So far, this technique has been able to produce spectra of Earth only in the optical band and it is limited to edge-on viewing angles, by design. Although some low spectral resolution whole Earth spectra have been obtained in the mid-infrared, the AIRS spectra are the first directly observed whole Earth high resolution infrared spectra ( $R \sim 1200$ ;  $3.75\text{--}15.4\ \mu\text{m}$ ) that span the seasons. Since AIRS also provides spatial information, we can combine the spectra with various weights to simulate possible spectra of other planets that might be observed with the Terrestrial Planet Finder (TPF) or Darwin. We explore the spectral signatures that are observable in the whole Earth spectra as well as their variation due to diurnal and seasonal effects, viewing angle, and land/ocean fraction. We also use the 4 Visible/Near-Infrared Channels of AIRS to investigate the range of vegetation signatures that might be observed in the visible and search for any additional correlations at infrared wavelengths.

